International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 8 Issue 1, January-February 2024 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

IoT Based Automatic Gas, Smoke and Fire Alert System

Md. Abdur Rahim[1], Md. Sanjidur Rahman[2], Rafat Ara[3]

[1,3]Assistant Professor, Department of CSE, German University Bangladesh, Gazipur, Bangladesh
[2]Student, Department of Electronics Technology, Rangpur Polytechnic Institute, Rangpur, Bangladesh

ABSTRACT

The goal of this system is to build an IoT based automatic gas, smoke and fire alert system via Node-MCU. We use a Node-MCU, sensors, a microcontroller system, and a few more electronic devices in the current endeavor. This endeavor has easy-to-use gas, smoke and fire detection. When people are outside of industries, residences, or marketplaces, they are not automatically informed about sudden events caused by fire, gas, or smoke. Not even fire departments receive the information instantly. People suffer greatly as a result, and most of the time, fire nearly destroys residences, companies, and marketplaces. However, our system may be able to help by automatically alerting concerned people to the presence of smoke, gas and fire. As a result, people will be able to arrive at the location swiftly and act promptly. For the system to obtain the data from the fire, gas and smoke sensors, a microcontroller needs to be installed to control every device involved in this work. Wi-Fi shield functions a way to connect devices with the network. This system uses an Android app to retrieve the sensor's data. This experiment analyses the room's performance in various fire, gas, and smoke conditions as well as burning objects. The researchers found that when smoke concentrations rise above 100 parts per million, people may get fatal heart attacks, coughing fits, and stinging eyes. However, when the smoke content hits 40 parts per million, our system will automatically send out an alert message. With the help of our technology, we hope that individuals will be able to save their lives and property.

KEYWORDS: *Internet of Things, Node-MCU, Sensors, Gas, Fire, Smoke & Buzzer*

How to cite this paper: Md. Abdur Rahim | Md. Sanjidur Rahman | Rafat Ara "IoT Based Automatic Gas, Smoke and Fire Alert System" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-8 | Issue-1, February 2024, pp.503-506, URL: www.ijtsrd.com/papers/ijtsrd63446.pdf

IJTSRD63446

I. INTRODUCTION

Every country has regular fire incidents in its marketplaces, companies, and residences. It increases fatalities and destruction because to inadequate fire extinguishing systems, emergency escapes, and fire alarms. Security-related issues are something we cannot take lightly. Security is the degree of safety from harm and loss. In today's technologically advanced society, individuals rely on technology to help them receive early warning alerts so they have enough time to escape harm. The three most dangerous sources identified during project design are smoke, gas leaks, and fire. This is due to the fact that both of these could turn into major catastrophes if prompt security measures are not implemented. Our product will function as a sentinel that is managed from a central console room in order to reduce fire incidents. We employed a very sensitive smoke detector for detection, which sends a high pulse to the input pin of the microcontroller, which is preprogrammed to produce the necessary output signal. The goal of this work is to create an alert warning system using a network of Node Microcontroller Units (Node-MCUs). It will be employed for both fire and natural gas detection. The circuit's sensors will detect any gas leaks or fires, and the Node-MCU will send out an SMS alert to the user and the closest fire station. The owner can respond more quickly when the technology offers real-time notifications. This will help the condition right away. This system can be placed wherever it deems necessary, including kitchens, rooms used to store liquefied petroleum gas (LPG), within easy reach of a mobile home's natural gas vehicle (NGV) tank, and anywhere else.

The way we connect with our environment has been completely transformed by the Internet of Things (IoT), which has improved efficiency and safety in a variety of fields. The creation of an automated alert system for gas, smoke, and fire detection is a crucial use of IoT. With its creative use of modern sensors and networked devices, this system marks a substantial advancement in the protection of people and property. As urbanization continues to grow, fire-related incidents have become a major concern.[1] To address this issue, an IoT-based automatic alert system uses intelligent sensors placed in vulnerable areas. These sensors can detect temperature spikes, gas leaks, and smoke particles, providing advanced warning of potential danger. Its ability to gather real-time data from the sensors is the core functionality of this system. A linked network is immediately alerted by the system upon detection of a potential hazard. Fast evacuation and prompt emergency services assistance are made possible by this immediate response, which also helps to keep events from getting worse. The IoT integration in this alert system enhances adaptability and responsiveness by integrating smart devices, ensuring comprehensive coverage and a nuanced understanding of situations. The automatic alert system is versatile and scalable, suitable for various environments like residential buildings and industrial facilities, offering a robust solution for unique challenges. In terms of user interface, the system offers real-time updates via a dashboard that is easy to use and available across several platforms. This makes sure that authorities and residents are informed, which facilitates prompt decision-making. Furthermore, the system may be set up to deliver notifications or text messages as alerts, making sure that people receive important information even when they're on the go. An innovative approach to safety measures is the automatic fire, gas, and smoke alert system that are based on the Internet of Things. Through the utilization of sophisticated sensors and networked devices, this system not only effectively identifies possible threats but also expedites reaction times, thereby mitigating the consequences of crises. These kinds of creative ideas are essential for building safer, more resilient communities as our cities expand and technology advances.

II. Proposed System

The implementation of gas, smoke and fire sensors may significantly enhance the safety of these processes. In the event that a fire breaks out or a certain gas concentration is surpassed, the detectors can be used to sound an alert. This can help to assure people's safety by providing ahead notification of a risk. Prior to any other leakage based on gas density, the sensor will first sense the temperature. It will then send this information to the microcontroller in the form of an electrical signal. Afterward, through programming or coding fed into the Arduino, a signal will be sent to the peripheral components and a specific message, along with a mobile number and an activated buzzer, will be sent. When this failure occurs at random, the system will sound a piezo alarm and contact the members of the security panel via cell phone. In a similar way, smoke and fire sensors will transmit signals just like gas sensors do.

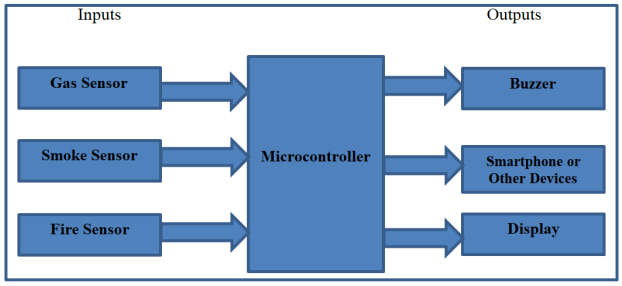

Fig 1 Block Diagram of the Proposed System

A. Necessary Tools

1. NodeMCU(Node Micro Controller *U*nit):

An affordable System-on-a-Chip (SoC) known as the ESP8266 serves as the foundation for the NodeMCU (Node MicroController Unit), an open-source software and hardware development environment. The CPU, RAM, networking (WiFi), and even a contemporary operating system and SDK are all present in the Espressif Systems-designed and -manufactured ESP8266. For Internet of Things (IoT) projects of all kinds, this makes it a great option.

But the ESP8266 is equally difficult to access and use as a chip. For the most basic functions, like turning it on or sending a keystroke to the chip's "computer," you have to solder wires with the proper analog voltage to its pins. It must also be programmed using low-level machine instructions that the chip hardware can understand. Using the ESP8266 as an embedded controller chip in mass-produced devices does not present a challenge at this level of integration. For enthusiasts or students wishing to experiment with it in their own IoT projects, it is a significant burden.[2]

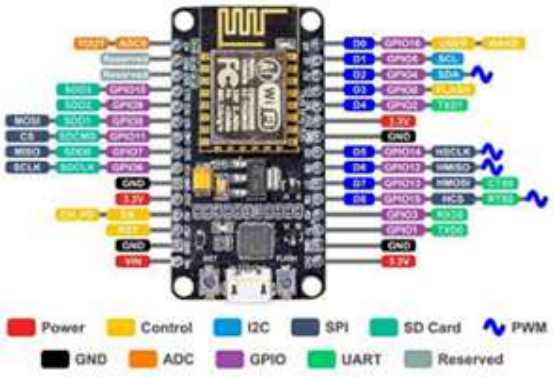

Fig 2 NodeMCU(*N*ode *M*icro*C*ontroller *U*nit)

2. Gas Sensor:

The MQ2 gas sensor is an electrical device that detects air gases, including carbon monoxide, alcohol, hydrogen, propane, methane, and LPG. When the sensor material comes into contact with the gas, it changes resistance. The detection of gas is accomplished by this change in resistance. The MQ2 gas sensor is a metal oxide semiconductor device. A voltage divider network included within the sensor is used to monitor the concentration of gas in the gas. The voltage needed for this sensor is 5V DC. It has a detection range of 200–10,000 ppm for gases.[3] The sensor consists of a ceramic sensing device covered with aluminum oxide and housed in a stainless steel mesh, with six legs for output signals and heating. Because donor electrons are attracted to the substance, high-temperature oxygen deposited on it blocks current flow. As reducing gases lower the surface density of oxygen, current and analog voltage values are produced. Higher voltage values are the result of greater gas concentration.[4]

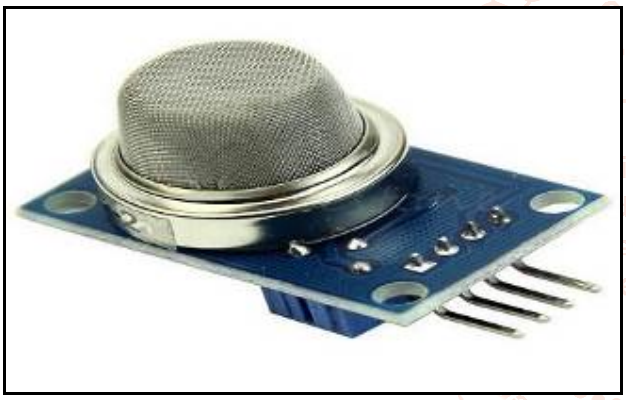

Fig 3 MQ2 Gas Sensor

3. Smoke Sensor:

An electronic smoke sensor alerts building inhabitants to the possibility of fire by automatically detecting the presence of smoke, one of the main indicators of a fire. A building's central fire alarm system includes commercial and industrial smoke detectors that send a signal to a fire alarm control panel. Every business is required by law to have a smoke detection system. Smoke alarms, often known as household fire alarms, sound a localized alarm from the detector itself that may be seen or heard. These can be a few hardwired (mains-powered) devices that are networked together or a single battery-powered one. After significant renovations, the latter must be placed in all newly constructed buildings.[5]

Fig 4 Smoke Sensor

4. Buzzer:

A buzzer, beeper, or other auditory signaling device can be mechanical, piezoelectric, or electromechanical in nature. This is mostly used to convert the audio signal to sound. It is often powered by DC voltage and found in computers, printers, alarm clocks, timers, and other devices. Depending on the many designs, it can make a range of sounds, such as alarm, melody, bell, and siren. A DC power supply with a voltage range of 4V to 9V powers the buzzer. This is powered by a 9V battery, however a regulated +5V/+6V DC supply is advised. Typically, a switching circuit is used to link it, allowing the buzzer to be turned on or off at the appropriate period.[6]

Fig 5 Buzzer

Advantages of IoT based automatic gas, smoke and fire alert system

- The sensor responds quickly and has outstanding sensitivity.
- The technology is safe, impenetrable, and incredibly dependable.
- When compared to the manual approach, the maintenance costs are incredibly minimal over time.
- The sensor responds quickly and has outstanding sensitivity.
- It serves as a liquor tester because it has the ability to detect alcohol.
- Assure complete safety by keeping individuals safe and issuing warnings.

- Minimize the quantity of a building's devastation.
- Both property and life safety.
- Reduction of needless disruptions to business.

Disadvantages of IoT based automatic gas, smoke and fire alert system

- The primary drawback of alarm system installation is the related expense.
- Furthermore, if false alarms brought on by malfunctioning sensors happen too frequently, they may be expensive (in the form of fines) and inconvenient for building tenants and homeowners.

CONCLUSION

Although a fire occurrence is completely unanticipated, we can defend against it or lessen its catastrophic effects through the use of an automated control system. Gas leaks that cause deadly fires are becoming a major issue in residences and other places where gas can be utilized and handled. Gas leaks cause a variety of mishaps that cause loss and damage to people as well as financial loss. This system can be utilized in retail centers, hospitals, housing areas, ships, universities, apparel manufacturers, and industrial regions (substation, boiler room, dying room, and power control room). In addition to shutting off the gas supply valve as a major safety precaution, the effort intends to design a system that monitors temperature and gas leaking and alerts this describer through alarm and cell phone message. For this system to receive the message, an ongoing internet connection is required. This technology cannot control smoke, gas, or fire without human intervention. In the near future, a detector, however, does not stop leaks from happening or suggest what should be done. It does not take the place of safe maintenance procedures and working methods. We will update our system soon so that it can automatically control any unplanned fire, gas or smoke incidents.

REFERENCES:

[1] https://www.ibm.com/topics/internet-of-things

[2] https://www.make-it.ca/nodemcu-details-specifications/

[3] M. Maheshkumar, S. Charandeep Reddy, K. Sai Prasad, B. Jagadeesh, S. Shahid, B. Riyaz Basha, “IoT Based Automatic Fire Detection and Precautionary System” International Journal of Research Publication and Reviews, Vol 4, no 4, pp 3505-3509, April 2023.

[4] https://www.elprocus.com/an-introduction-to-mq2-gas-sensor/

[5] https://www.ifsecglobal.com/smoke-detectors/#:~:text=A%20smoke%20detector%20is%20an,a%20warning%20to%20building%20occupants

[6] https://www.elprocus.com/buzzer-working-applications/

[7] Jenil Dosani, Nikunj Makwana, Archana Chaugule, ”NodeMCU based Fire Detector System”, HBRP Publication, Recent Trends in Cloud Computing and Web Engineering Volume 2 Issue 3, 2020.

AUTHORS PROFILE

Md. Abdur Rahim teaches as an Assistant Professor at German University Bangladesh in Gazipur, Bangladesh, in the Department of Computer Science and Engineering. He received his M.Sc. in computer science from Jahangirnagar University (JU), Bangladesh, and his B.Sc. in computer science and engineering from Jatiya Kabi Kazi Nazrul Islam University (JKKNIU), Trishal, Mymensingh, Bangladesh. He has authored numerous research articles for both domestic and foreign publications. Software engineering, cloud computing, Internet of Things, blockchain technology, internet and web programming, and wireless communications are some of his areas of interest in research.

Md. Sanjidur Rahman is a student in the department. of Electronics Technology at Rangpur Polytechnic Institute, Rangpur, Bangladesh. He has research interests in robotics and Internet of Things.

Rafat Ara teaches as an Assistant Professor in the German University Bangladesh's Department of Computer Science and Engineering in Gazipur, Bangladesh. She graduated with a B.Sc. in computer science and engineering from Jatiya Kabi Kazi Nazrul Islam University (JKKNIU) in Bangladesh and an M.Sc. in computer science from Jahangirnagar University (JU) in Bangladesh. Her research interests include cloud computing, artificial intelligence, computer networks, Internet of Things, software engineering, cryptography, and network security. She has published research papers in a number of national and international journals.